Non-Linear Animation for Production

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"Production studios, 3D animators, and vendors of many popular computer graphics packages are increasingly using the term "non-linear animation," which usually describes a way of working with various types of motion data at a higher level where animation sources are abstracted to transportable snippets. Nonlinear tools can be useful in many areas of production, such as previsualization, animation creation, motion editing, retargeting and reuse, choreography, and actor direction. This panel discusses practical and speculative uses of non-linear animation techniques in a production environment."

Raf Anzovin
Non-linear animation systems (NLAs) represent the first real improvements on the traditional keyframe animation system. A well-implemented NLA is both an animation editing system, with features analogous to those of nonlinear video editing systems, and an animation-compositing tool that enables the animator to create layers of movement and specify Boolean and other interaction modes among them. These extensions of traditional capabilities are, in my experience, quietly revolutionizing animation practice, and they will have greater impact as NLA tools become more familiar to working animators.

At our production studio, NLA software has become an essential part of the animation process. In fact, it is the indispensable facilitator of everything we produce. NLA tools enable our animators to manipulate their work as a composite of separable but interdependent "actions." Actions can be quickly repurposed for different projects, which is crucial for that segment of our business in which we produce sets of training animations that work variations on a single theme. Moreover, actions are easily shared among animators, which enables those with less experience to quickly build on the work of more experienced artists. The result is a more flexible workflow that is fast, efficient, cost-effective, and well-suited to mass production of commercial and industrial animation, and to hand-crafted works of animation art.

Award-winning filmmaker Raf Anzovin is the co-founder and creative director of Anzovin Studio, a rapidly growing animation company that provides character design and animation for film, video, and interactive media. He is the founding instructor of the advanced character animation courses at the Computer Science Department, University of Massachusetts, Amherst, and runs a yearly animation internship program for five college-area students. From 1999 to 2000, he wrote the monthly animation column for 3D Magazine, and since 1996, he has served as contributing editor for MacAddict magazine.

Michael Isner
The main benefits of NLA are:

1. A framework for reducing the complexity of multi-channel animation tasks. This includes blending, layout, cleanup, mirroring, breaking into parts, and assembling. Compounds also speed up manipulation of interdependent channels.

2. Mixing keys, expressions, and constraints open up the opportunity for blends of keys and relations. For example, "canned animation" and live goal blends are useful for a character that is grabbing onto something (where the something may change position).

3. It brings SRT (scale, rotation, translation) animation into a container that can be used in character setup. Because this container can be weighted and driven in a manner similar to shape animation, many of the character-setup techniques that have evolved from facial animation can be implemented on SRTs. Useful applications range from hand setups to universal facial rigs that are independent from form and features.

4. It's a compositing tool for hybrid motion capture and keyed animation workflows. Moving from pre-viz to a finished shot is generally a transition from raw motion capture to refined animation. This refinement can happen in many different ways, ranging from substitution, extraction (a pipeline to convert mocap into keys), and blending.

Michael Isner works through Softimage Special Projects as a consultant for film and game projects. His experience ranges across modeling, rendering, animation, and character setup and he has written copious custom tools for XSI, ranging from mirroring tools to bone matching heuristics and dynamics. Previously, he was the demo lead in the Softimage Content Group, which put NLA through its first production scenarios. Some of his recent character work can be found at: www.isner.com/new.htm

Laurent Lavigne
NLA is an entirely new way to think and deal with motion as an abstraction. The editing paradigm inherent with this abstraction allows the user to focus on events and timing, so it becomes an ideal tool for communication with a director or an editor. Pixel Liberation Front is a company that specializes in pre-visualization for movies and commercials. This is an area where communication with non-technicians is of paramount importance, and one cannot get stuck in the details of animation. NLA was a natural extension of our tool set. It enables pre-viz artists to separate the details of action from the elements of a shot's composition. It eases creation of shots and their deconstruction. It allows, through swapping of motion clips, scaling of the quality of a shot from rough "sliding people" to a fully moving mocaped pre-movie.

Laurent Lavigne is currently working on the pre-visualization of the second "Matrix" movie. In this process he is animating and deconstructing complex stunts and fight sequences. He became part of the pre-viz team at PLF on David Fincher's last

production, "Panic Room," which (unusually) required pre-viz of the entire movie. Prior to that, he worked for four years in post production, supervising character animation special effects for movies and commercials ("Mortal Kombat," "DnD," Radioshack, Snickers, and others). He started his career in the US working in the gaming industry as a designer and supervisor of animatics. He moved to the US to attend film school at the University of Southern California, where he received an MFA. He also has a master of computer science from Jussieu in Paris, with an emphasis on user interface and L-system fractals.

Greg Punchatz
My first reaction to the concept of NLA was the same as the reaction of many other animators. I thought it was a cute software demo, but I probably would never really use it very much. I was wrong. Now I use NLA every day, in ways I never imagined. One of the more interesting things we have done with it was editing a three-minute short film in XSI, where we switched among 35 different cameras using the Animation Mixer. This led me into the whole concept of non-linear film making, in which you could have animators, compositors, and editors on set with the rest of the crew for roughing out effects and edits while scenes are being shot. I really believe this is the future of filmmaking.

Greg Punchatz is director of animation at Janimation. He comes from a background of special makeup effects and animatronics, and he has an artistic family (his father is a well-known illustrator, Don Ivan Punchatz). He attributes his attention to artistic detail to the long hours spent watching his father create his magic through painting. He had an early fascination for fantastic characters, which led to his first career as a special-effects makeup artist. Some of his credits include: the "Robocop" trilogy, "Coming to America," and "Nightmare on Elm Street 2." He has also created stop-motion models for various video games, including the mega-hit Doom.

After seeing Jurassic Park for the first time, he knew that he would have to change his "set of tools" if he wanted to continue creating cutting-edge characters. In 1995, he joined Janimation and traded in his sculpting tools for a mouse. One of Greg's favorite projects to date is a CG turtle for Harrah's Casino, which won the "Big Kahuna" award for commercial animation last year.

Seth Rosenthal
Motion-captured animation is a lot like keyframe animation, but it has important characteristics that motivate an emphasis on different editing techniques. In particular, the data are dense and difficult to edit directly. Higher-level editing techniques such as NLA and layer-based editing allow animators to easily manipulate important aspects of motion-capture animation without having to directly edit the original dense data. In addition, the ability of motion capture to generate a large volume of realistic human animation encourages development and use of techniques that can manipulate a library of existing animation as raw material to be formed into new and different performances. NLA and related techniques not only provide artists with better tools for manipulating animations, but they also increase the value of existing collections of animation data.

ILM has used motion capture in shots ranging from dramatic hero performances of the title character in "The Mummy" and "The Mummy Returns" to large crowds in the battle sequence of Star Wars: Episode One "The Phantom Menace" and the intricate three-person dance routine in the Rhythms, Data Dancers commercial. These shots involved complex multi-character performances, elaborate interaction with elements in the live-action plate, and choreography of entire armies. In order to complete this work, we relied on a wide range of animation editing techniques including manual adjustments, animation layering, blending, re-timing, and procedural crowd simulation. In addition, many of our shots made use of secondary simulations of cloth, armor, or flesh, which imposed limits on the physical plausibility of the underlying animation by magnifying editing artifacts such as excessive accelerations. We are working to extend the usefulness of motion capture as a tool for feature film production by exploiting a range of editing techniques that allow us to provide directors with more flexibility in experimenting with and modifying animation and choreography.

Seth Rosenthal joined ILM in 1998 as motion capture supervisor, where he oversees recording and processing of motion-capture data for feature film and commercial productions, and works with the research and development department to develop new technology for integrating motion-capture techniques with ILM's visual effects production pipeline. At ILM, he has supervised motion-capture production for Star Wars: Episode I "The Phantom Menace," "The Mummy," and the Rhythms, Data Dancers commercial. He is currently working on "The Mummy Returns," "Pearl Harbor," and "A.I."

Before joining ILM, he managed production of 3D content for Microsoft's Digital Media Center, where he collaborated with the Human Figure Animation Project at Microsoft Research to adapt their motion-capture processing and animation system for use in production. He earned a bachelor of arts in history from Oberlin College in 1988.

Gordon Cameron
Gordon Cameron is development manager for Softimage|XSI. He previously served as project leader for animation and a lead developer on the animation mixer NLA and has worked over the years in other areas such as motion capture, real-time viewing, performance animation, etc. He organized a SIGGRAPH 97 panel on motion capture and character animation and was editor of SIGGRAPH's Computer magazine from 1996 until 2001. He previously worked in the fields of parallel computing, robot vision, and scientific visualization.